

The Coal Authority
200 Lichfield Lane
Mansfield
Nottinghamshire
NG18 4RG

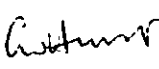
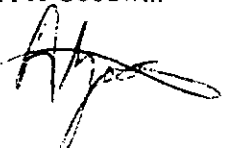
Strafford Minewater Treatment Scheme Ground Investigation

January 2008

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Strafford Minewater Treatment Scheme Ground Investigation

Issue and Revision Record

Rev	Date	Originator	Checker	Approver	Description
A	Jan 2008	Peter Fair 	Chris Hurst 	A K Goodwin 	First Issue

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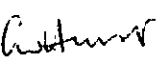
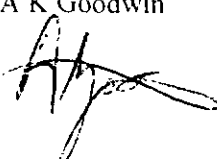
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1 Introduction

The construction of a pond, wetland and other associated works is proposed at the former Strafford Colliery tip site, Gilroyd Lane, Stainborough, Barnsley, in order to prevent the discharge of minewater into House Carr Dike.

The site is a former colliery tip and the ground surface comprises rough grass with many minor changes in topography. The site slopes from north to south, from approximately 93mAOD on the northern boundary (Trans-Pennine Trail) to approximately 81 mAOD at the southern boundary.

The following planning condition was applied to the site:

“Prior to the commencement of development the following should be carried out:

- a) a borehole location plan shall be submitted to and approved in writing by the Local Planning Authority;
- b) drilling to be carried out in accordance with the approved scheme and;
- c) the results submitted to the Local Planning Authority including any mitigation deemed necessary to remove the risk of collapses from any shallow underground workings encountered.”

A borehole location plan was submitted to the Local Planning Authority (stage a above) and approval given for the ground investigation which took place during the week commencing 3 December 2007 (stage b). This report considers stage (c) above and discusses the findings of the ground investigation.

The main settlement pond will be earthwork construction with excavated material from the base placed and compacted to form the tops of embankments. The settlement pond will hold water to a depth of 3m with internal batters sloping at 1:2. The depth of water in the reed bed will be limited to 300mm with 300mm of topsoil in the base of the bed.

A 2mm thick HDPE impermeable membrane will be laid over the trimmed surface of the earthworks and anchored at the top of the embankments to seal the base of the settlement pond.

2 Scope of Works

Seven rotary open boreholes were drilled by Ritchies during the week commencing 3 December 2007, as shown on the Ground Investigation Layout Dwg. 239277/0124. The depths of the boreholes are listed in Table 1 below. Full details of the strata encountered and the installations are included on the borehole records in Appendix A.

Table 1: Depth of Boreholes

Borehole	Depth below ground level (m)
BH1	14.0
BH2	20.0
BH3	20.20
BH4	19.0
BH5	14.0
BH6	20.0
BH7	15.6

Each hole was backfilled on completion with cement/bentonite grout. No instrumentation was installed.

3 Geology

The geological map of the area (Sheet 87, Barnsley, 1:50,000, Solid and Drift Edition) shows the site to be underlain by Middle Coal Measures of the Upper Carboniferous Period dipping to the north-east. The dip of the strata is unclear. These strata typically comprise interbedded mudstone, siltstone, sandstone and coal, with named sandstone units. Alluvium is shown to outcrop close to the stream on the southern boundary of the site (House Carr Dike).

The Flockton Thick seam is shown to outcrop to the west of the site, and dips beneath the site to the north-east. The Fenton Seam outcrops further west and dips beneath the site below the Flockton Thick. The memoir for the Barnsley area (Sheet 87) suggests that the Flockton Thick (near Dodworth) is usually in two beds, the upper about 1ft thick and lower about 2ft thick, separated by 3 to 4ft of dirt.

Geological information supplied by the Coal Authority shows the Joan Coal to outcrop across the central part of the site; this is not shown on the 1:50,000 map. The Barnsley area memoir reports that the Joan Coal is some 20m (60ft) above the Flockton Thick. It is reported as being very consistent with an average thickness of 18ins and has only been worked over a small area at Dodworth.

Information supplied by the Coal Authority shows workings associated with the Flockton Thick seam to be present beneath the eastern part of the site. The information indicates that the Flockton Thick is present at 82 mAOD (9m below current ground level) in the vicinity of the proposed pond, and at 76 mAOD (14.5 mBGL) further east in the proposed reed bed area. The Coal Authority Records show the Joan Coal to have been mined by open cast to the north of the Trans-Pennine Trail.

3.1 Previous Ground investigation

A ground investigation was carried out at the site during October 2005 by Ritchies. Six trial pits and a trial trench were excavated to depths between 1.8m and 3.4m and 6 No. windowless sample boreholes were sunk to depths between 1.05m and 4.45m. Two cable percussion boreholes were sunk to depths of 4.45m below ground level. A brief summary of the ground conditions is given below:

Made Ground: present in all the exploratory holes, with a minimum thickness of 1.80m. Several of the exploratory holes terminated in the made ground at depths up to 3.40m.

The made ground was typical of colliery spoil and demolition material, typically comprising sand and gravel of mudstone, sandstone, coal, concrete and ash. Burnt spoil was present in some location.

Alluvial clay: soft to firm organic silt/clay was encountered from 2.40m to 2.50m in TP3. This could represent alluvium or the base of a previous lagoon. Soft to firm, firm or firm to stiff grey mottled orange slightly sandy slightly gravelly clay was encountered in TP2, TP3, BH1 and BH2. The material was encountered beneath the made ground and was proven to a maximum depth of 4.25m. Ritchies describe the material as Alluvium, although it could represent weathered Coal Measures strata.

Coal Measures: possible highly weathered mudstone was present in BH2 from 2.70m to 4.10m, with weathered grey mudstone encountered below. Possible sandstone rockhead was encountered in BH1 at 4.25m.

No rotary drilling was carried out into the Coal Measures strata, and no coal seams or workings were encountered in the October 2005 investigation.

4 Ground Conditions

Table 2 below outlines the results from the rotary open cored holes at Strafford MwTW undertaken by Ritchies during the week commencing 3 December 2007.

Table 2: Ground Conditions

Strata	Depth bgl (m)	Thickness (m)	Description
Made Ground	0 – 2.5	0.6 – 2.5	Black slightly sandy gravelly clay, partly of ash. Gravel is subrounded to angular of mudstone, sandstone and coal. Occasional cobbles and bricks.
Clay	0.6 – 4.7	0 – 3.8	Light brown sandy gravelly clay, locally orange slightly sandy mottled clay.
Mudstone	0.7 – not proven		Grey / light grey slightly weathered mudstone.
Coal	11.2 – 19.2	0.2 – 1.3 where present	Coal (BHs 1, 3, and 4)
Possible Voids	10.0 – 14.6	0.6 – 2.7 where present	Fractured Ground – Possible voids (BHs 5 and 7)

From Table 2 above it can be seen that the site at which the Strafford MwTW is proposed to be constructed is underlain by fractured geology at some locations. With the information provided from the ground investigation it is not possible to provide conclusive cross sections of the underlying strata. However from the above results conclusions can be drawn for the area of the primary settlement pond and the area of the reed beds.

4.1 Primary Settlement Pond

The primary settlement pond is to be constructed on the western side of the site to a depth of 4m below ground level. Two boreholes were drilled in the region of the primary settlement pond, BH1 through the base of the proposed pond and BH2 through the batter on the northern side of the settlement pond. From BH1 it can be seen that coal was encountered at a depth of 11.2m bgl. There was no evidence of any voids or fractured ground to a depth of 14m. From the Coal Authority mining records it was not anticipated to find workings at this location.

BH2 was positioned north east of BH1 and outside of the planned excavation of the primary settlement pond. From the Coal Authority plans it was anticipated that workings would be found at this location. No coal or workings were found in BH2. However loose ground was recorded by the driller between 0.6 and 8.1m bgl and a partial loss of flush was recorded at 3.5m which could represent a possible void. A loss of flush was also recorded at 15.80m; this may represent a possible void or the loss of flush may have been due to the drilling difficulties experienced at this depth.

4.2 Reed Bed

The reed bed is proposed to be constructed to the east of the primary settlement pond, with only very shallow excavations proposed. Boreholes BH4, BH5 and BH7 are situated within the area of the proposed reed bed.

These show coal in BH4 between 16.2 – 16.6m and 17.7 – 17.9m bgl, and fractured ground (possible voids) in BH5 at 10.0 – 12.7m bgl and in BH7 at 14.0 – 14.6m bgl. From the Coal Authority mining records it was not anticipated to find workings in BH4 or BH7, but they were anticipated in BH5. No returns were obtained from the drilling immediately below the fractured ground in BH5 from 12.7 - 14m and in BH7 from 14.6 – 15.6m.

5 Discussion of Findings

The rotary open hole investigation carried out by Ritchies during December 2007 revealed Made Ground of variable thickness overlying weathered mudstone and/or Alluvium, with Coal Measures strata at depth. The Coal Measures strata comprised mudstone with coal seams.

The Flock Thick and the Joan Coal outcrops were plotted on the drawing (239277/124), it can be seen that the Joan Coal as discussed in Section 3 is just touching the north east of the site. As the strata dips to the north east, the Joan Coal should therefore not affect the site. The Flockton Thick outcrops to the south of the site beyond the limits of the drawing. This seams dips below the site. It should be noted that the memoir describes the Flockton Thick as being a split seam in the area of Dodworth. The thicknesses of the seams and distance between them are consistent with those reported in the memoir (see Figure 1).

Intact coal seams were encountered in boreholes BH1, BH3 and BH4. The coal was encountered at depths deeper than predicted from the Coal Authority information. Fractured ground, interpreted as possible voids, was present in boreholes BH5 and BH7, the shallowest being at 10m below ground level. A partial loss of flush was recorded at 3.50m and 15.80m below ground level in BH2, which could indicate possible voids or loose material. It is not clear whether the drilling at these depths encountered workings, collapsed strata into a worked seam, or just highly fractured ground.

The proposed primary settlement pond is located on the western part of the site and the closest exploratory holes are boreholes BH1 and BH2. Borehole BH1 is located within the deepest part of the proposed excavation and intact coal was recorded at 11.2m below ground level. A partial loss of flush was recorded in borehole BH2 at 3.5m, however this is unlikely to represent workings at this depth and is more likely to indicate loose material. A further loss of flush associated with drilling difficulties was recorded at 15.8m in BH2. These difficulties may be the result of encountering broken / collapsed ground caused by previous mining since 15.8m is at the depth where the conjectured Flockton Thick intersects BH2, as indicated on Figures 1 and 2.

It is considered that the proposed works for the primary settlement pond have a low risk of being affected by coal workings. There is a low probability of the strata underlying the site collapsing into any mine voids. Such collapse would occur over a long period of time and may cause the foundation of the pond to be undermined. This in turn may cause the liner of the pond to fail and the mine water to return to the shallow mine workings producing a circulation of the mine water. Grouting of this collapsed / broken ground would then have to be carried out. This risk could be mitigated by carrying out a drill and grout programme in the affected area

The proposed reed beds are located to the east of the primary lagoon. Excavations for the reed beds are anticipated to be shallow, in the order of 1m below ground level. Collapse of possible workings at the depths recorded in borehole BH5 could in theory affect the reed beds if upward void migration was to occur. However, the strata from 10m to 12.7m are described as "fractured weak ground with loss of flush and increased rate of penetration. POSSIBLE voids". This suggests this zone could be collapsed material above a worked seam, or highly fractured weak rock, rather than a large void representing disused workings. Although it is unlikely that further migration would occur to the surface there is a moderate to low risk of the reed bed being undermined with the risk decreasing to the east, since the fractured strata dips to the north east. This risk can be mitigated, as above, by carrying out a drill and grout programme in the affected areas.

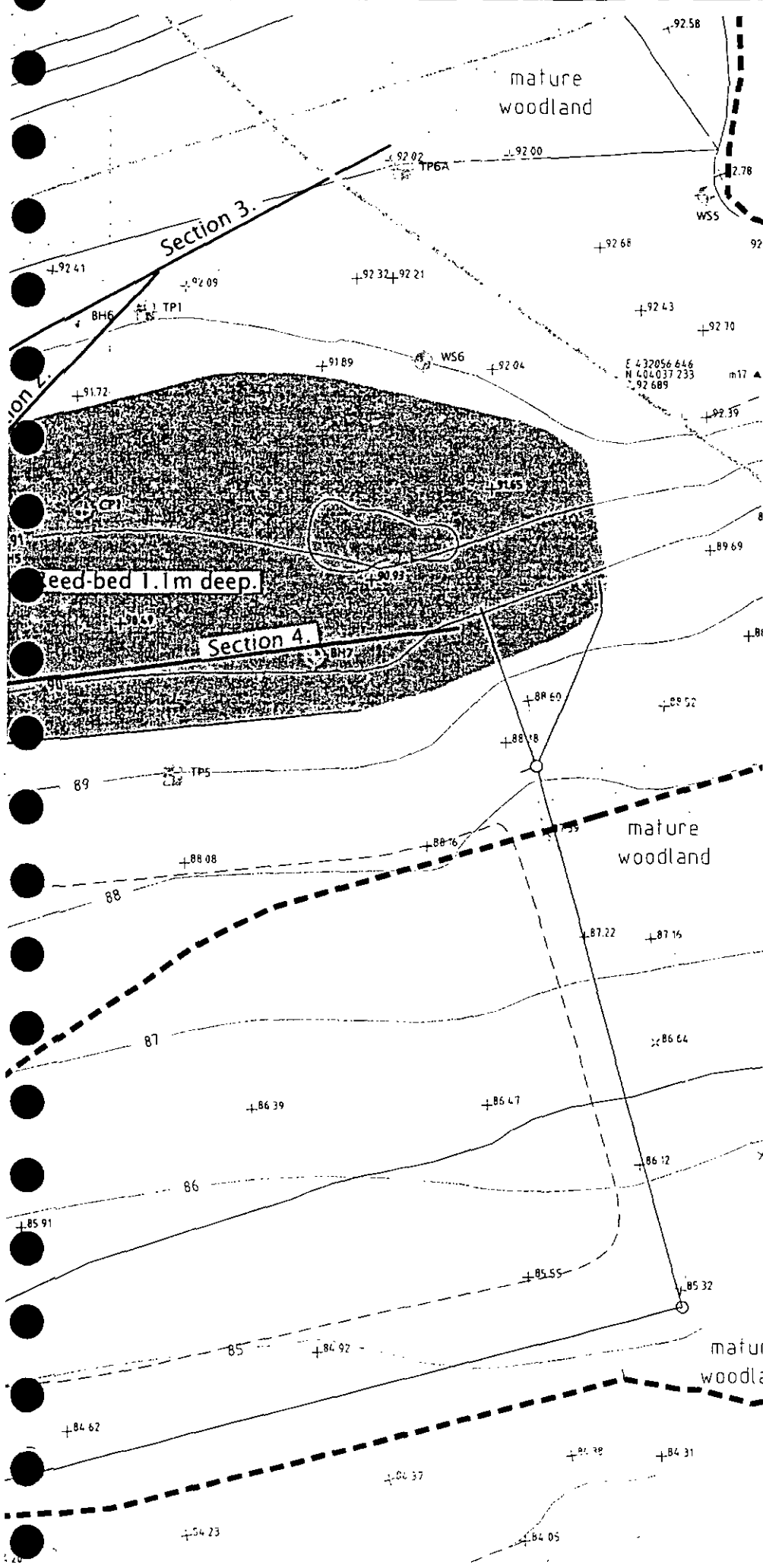
6 Conclusions

From the information obtained from this latest ground investigation it can be concluded that there is a low risk of any shallow workings being present that would affect the proposed settlement pond.

Under the proposed red bed the formation of the strata was unclear. There is some evidence that workings could be present however it may be that the rock is heavily fractured in boreholes BH5 and BH7. There is a moderate to low risk of the red beds being undermined by the possible workings.

Appendix A Drawings

Drawing 239277 / 0124 Ground Investigation Layout (Rev AB)



Notes

- Do Not Scale from this drawing.
- Out crop details taken from Coal Authority M.R.S.D.S. System by e-mail 10/08/07

Key to symbols

- CP1 Cable Percussive Borehole, approx location of Ritchies G.I. 2005.
- WS5 Window Sample, approx location of Ritchies G.I. 2005.
- TP2 Trial Pit, approx location of Ritchies G.I. 2005.
- BH1 Rotary Open Boreholes approx location of Ritchies G.I. 2007.
- Joan Seam.
- Flockton Seam (Site Not Affected).
- Area of excavation for proposed treatment ponds.

AB	17/01/08	SBL	As Built	BAP	MCS
Rev	Date	Drawn	Description	Chk'd	App'd

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Client

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200 Lichfield Lane
Mansfield
Nottinghamshire
NG18 4RC

Title

Strafford Minewater Treatment Scheme

Ground Investigation Layout

Designed	B A Penny	BAP	Eng Chk	P J Charlesworth	PJC
Drawn	S B Longder	SBL	Coordination	B A Penny	BAP
Dwg Chk	B A Penny	BAP	Approved	M C Simpson	MCS
Scale at A1	Project 239277			Status	
1:250	CAD file P:\239277\5.0\5.4\0100			ASB	
Drawing No	239277 / 0124				Rev
					AB

Based upon the Ordnance Survey Map with the permission of the controller of H.M. Stationary Office Crown Copyright Reserved Licence AL 549428

Appendix B Cross sections

Figure 1: Cross section 3

Figure 2: Cross section 4

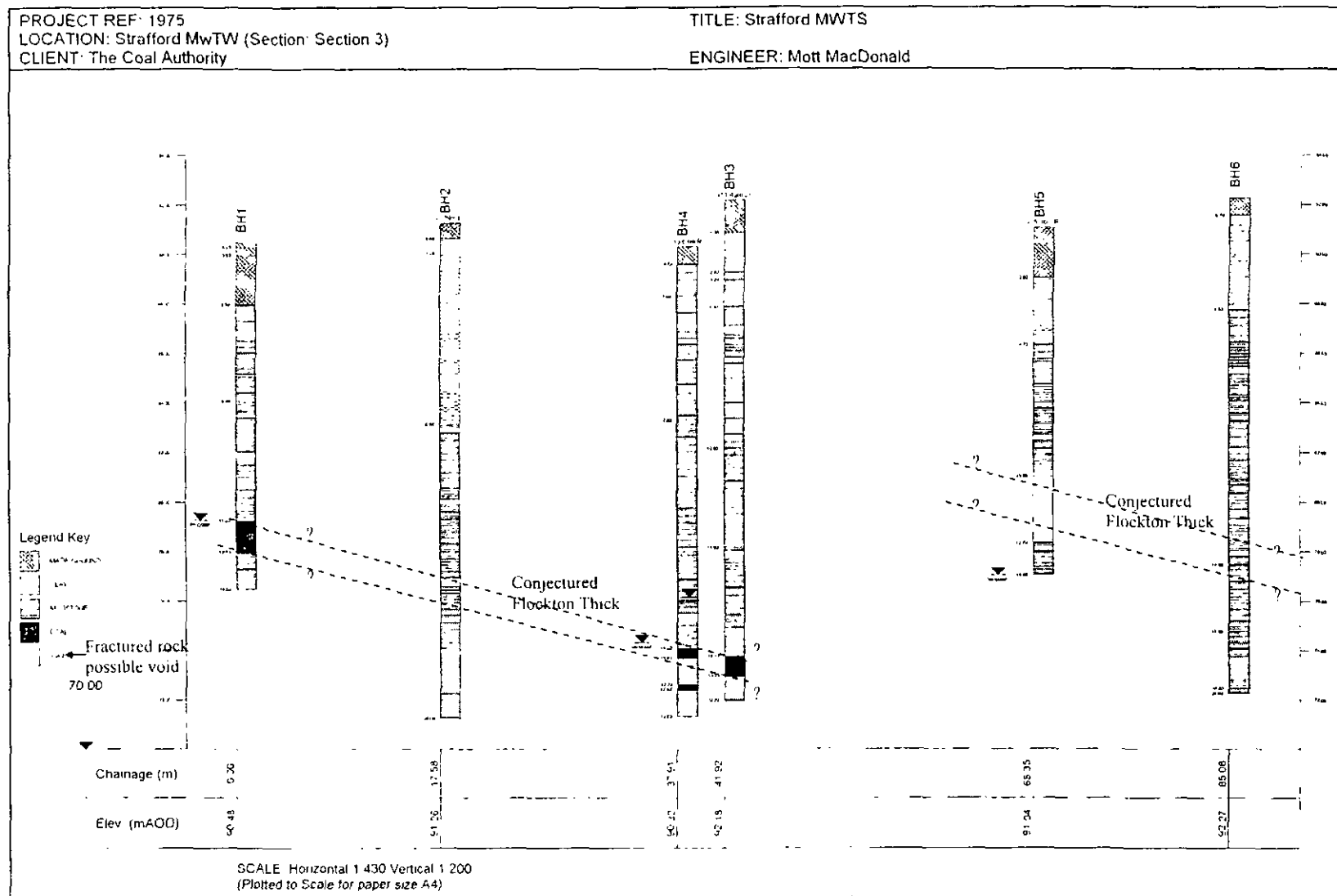


Figure 1: Cross Section 3

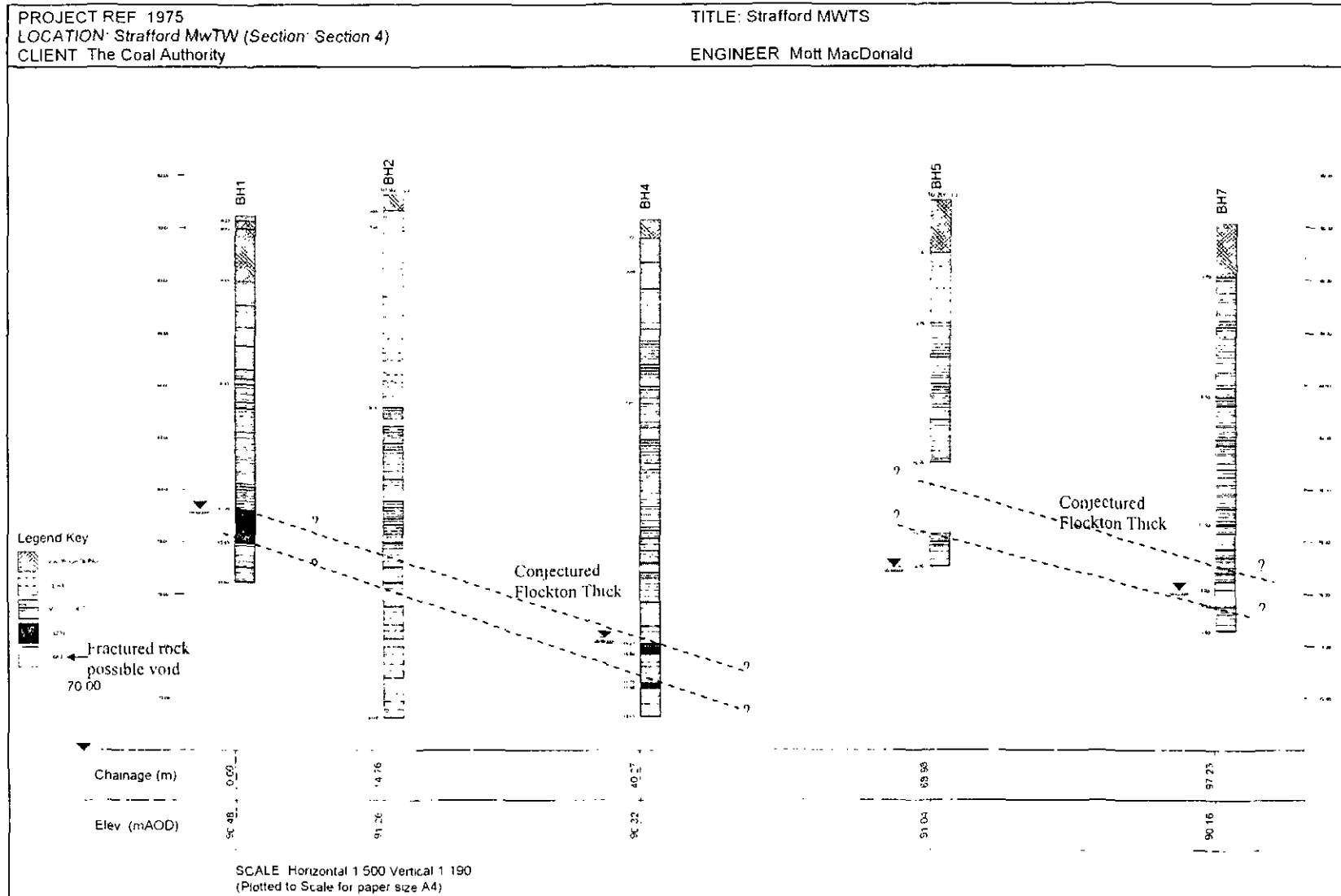


Figure 2: Cross Section 4

Appendix C Borehole Records (supplied by Ritchies)

22/01/2008



ritchies

BOREHOLE LOG

Sheet 1 of 2

Strafford MWTS

Consultant: Mott MacDonald

Job No: 1975

Equipment	Allas Copco Mustang A50
-----------	-------------------------

Core Bil

BTH

Scale

50

[illegible]

Continued next sheet

U	Undisturbed U-30 Sample
P	Piston Sample
TW	Thin Wall Sample
D	Small Disturbed Sample
B	Block Disturbed Sample
LB	Large Block Disturbed Sample
W	Water Sample
G	Gas Sample
C	Core
LC	Chemical Sample

CCR	Core Run
TCR	Total Core Recovery
SCR	Strid Core Recovery
ROD	Rock Quality Designation
FI	Fracture Index
FL	Fracture Log
NI	Not Intact
J*	Blows to drive U100/WB
NA	Not Applicable
NR	No Karstery

S	Standard Penetration Test
C	Cone Penetration Test
32	N for full 300-mm penetration
175	For given penetration (mm)
25#	Sealing bows only (mm)
NP	No Penetration
PM	Pressuremeter Test
K	Permeability Test (m/s)
V	Insitu Vane Test
-	Packer Test (ignores)

CP	Cable Percussion
RO	Rotary Open Hole
RC	Rotary Cased

	Stuffed Pipe		Sarg. Filter
	Piezometer Tip		Bentonite Seal
	Grout		Gravel Filter
	Casing		

Status
Prelim 2
22/01/2008



ritchies

BOREHOLE LOG

Borehole No
BH1
Sheet 2 of 2

Strafford MWTS

Client: The Coal Authority
Consultant: Mott MacDonald

Job No: 1975

Date Started: 04/12/2007
Date Complete: 04/12/2007
Hole Type: RO
Equipment: Atlas Copco Mustang 450

Initial Boring Diameter: 125mm
Initial Casing Diameter:
Rotary Casing Type:
Core Barrel:
Core Bit:
DTH

Coordinates: E 431922.50
N 404032.00
Ground Level: 90.49m OD
Plunge: 90°
Scale: 1:50

Description of Strata	Legend	Depth	Reduced Level	Sampling/ Core Run	In Situ Testing	TCR (SCR)	FI	Installation
Light grey MUDSTONE recovered as, sandy angular fine gravel								
Black Coal recovered as, sandy angular fine gravel		11.20	79.29					
Dark grey MUDSTONE recovered as, sandy angular fine gravel		12.50	77.99					
End of Borehole at 14.00 m		14.00	76.49					

U Undisturbed J100 Sample
P Push Sample
TW Thin Wall Sample
S Small Disturbed Sample
B Bulk Disturbed Sample
LB Large Bulk Disturbed Sample
W Water Sample
G Gas Sample
C Core Sample
DC Chemical Sample

TCR Total Core Recovery
SCR Solid Core Recovery
RQD Rock Quality Designation
FI Fracture Index
FL Failure Load
NI Not Initiated
U Not Applicable
NA Not Applicable
NR No Recovery

S Standard Penetration Test
C Cone Penetration Test
N Not for full 50mm penetration
F For given penetration (mm)
Z Sealings blows only (mm)
N Penetration
P Pressuremeter Test
K Permeability Test (kPa)
V Vane Shear Test
P Packer Test (log m/s)

CP Casing Penetration
RO Rotary Open Hole
RC Rotary Cased

Installation
G Grouted Pipe
P Perimeter Tap
G Grout
C Casing
S Sand Filter
B Bentonite Seal
G Gravel Filter

Status
Prelim 2
22/01/2008



BOREHOLE LOG

Borehole No
BH1
Information

Strafford MWTs

Client: The Coal Authority
Consultant: Mott MacDonald

Job No: 1975

Date Started: 04/12/2007
Date Complete: 04/12/2007
Hole Type: RO
Equipment: Atlas Copco Mustang A50

Initial Boring Diameter: 125 mm
Initial Casing Diameter:
Rotary Casing Type:
Core Barrel:
Core Bit: DTH

Coordinates: E 431922.50
N 404002.00
Ground Level: 90.49m OD
Plunge: 90°
Scale: 1:50

PROGRESS

Date	Time	Hole Depth	Casing Depth	Water Depth	Remarks
04/12/2007		14.00			BH complete

DRILLING / SAMPLING DETAILS

CP Chiselling			Probing Details		
From	To	Hours	From	To	Time (mins)
			1.20	2.50	125 mm 2 mins
			2.50	5.50	125 mm 4 mins
			5.50	8.50	125 mm 7 mins
			8.50	11.50	125 mm 4 mins
			11.50	14.00	125 mm 3 mins

WATER STRIKES

Date	Time	Strike	Risen to	After 20 minutes	Casing Depth	Flow	Sealed
04/12/2007		11.20				Slight seepage	

IN SITU SPT TEST DETAILS

Depth	Blows for 75mm increments
-------	---------------------------

NOTES

All depths in metres; all diameters in millimetres.

Groundwater levels are subject to seasonal, tidal and other fluctuations and should not be taken as constant.

1. Area CAT scanned and inspection pit hand dug to 1.2m prior to drilling commencing.
2. During drilling process driller notes coal seam between 11.2m and 12.5m.
3. BH terminated upon the Engineer's instructions at the scheduled depth of 14m within mudstone.
4. Backfill details as follows, 14.0m - GL bentonite pellets.

PERSONNEL

Driller: GC/CG/CS

Logged by: JMcK

Checked by: APB

Status
Prelim 2
22/01/2008



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BOREHOLE LOG

Borehole No
BH2
Sheet 1 of 3

Strafford MWTS

Client: The Coal Authority

Job No: 1975

Consultant: Mott MacDonald

Date Started 04/12/2007
Date Complete 06/12/2007
Hole Type RO
Equipment Atlas Copco Mustang A50

Initial Boring Diameter 125mm
Initial Casing Diameter 114mm
Rotary Casing Type Symmetrix N82
Core Barrel
Core Bit DTH

Coordinates E 431935.40
N 404015.00
Ground Level 9.27m OD
Purge Scale 90.1
1.50

Description of Strata	Legend	Depth	Reduced Level	Sampling/ Core Run	U	In Situ Testing Test	Result	TCR (SCR) RLO	FI	Installation
MADE GROUND: Brown slightly clayey gravelly sand with occasional cobbles of brick. Gravel is sub-angular fine to medium of mudstone and brick		0.60	90.67							
Orange brown slightly sandy mottled CLAY		1.20	90.07							
Light brown orange mottled gravelly CLAY with occasional fine rootlets and inclusions of fine coal. Gravel is weathered mudstone										
around 3.5m driller notes partial loss of flush, possible void space or loose material										

Continued next sheet

U Undisturbed U100 Sample
P Pushin Sample
TW Thin Wall Sample
D Disturbed Sample
b Bulk Disturbed Sample
LB Large Bulk Disturbed Sample
W Wall Sample
G Gas Sample
C Core
DC Chemical Sample

TCR Total Core Recovery
SCF Split Core Recovery
RDI Rock Quality Designation
FI Fracture Index
FL Fracture Log
N No Contact
U No Flow to drive U100/U46
NA Not Applicable
NR No Recovery

S Standard Penetration Test
C Cone Penetration Test
N for lub 300mm penetration
For given penetration (mm)
Sealing blow only (mm)
NP No Penetration
PR Presumptive Test
K Permeability Test (ms)
V Insitu Vane Test
I Packer Test (Logans)

CP Cable Percussion
RO Rotary Open Hole
RC Rotary Corred

Installation
S Sorted Fines
P Proximeter Tip
G Gravel
C Concrete
Sd Filter
R Radial Seal
G Gravel Filter

Status
Prelim 2
22/01/2008



ritchies

BOREHOLE LOG

Borehole No
BH2
Sheet 2 of 3

Strafford MWTS

Client: The Coal Authority

Job No: 1975

Consultant: Mott MacDonald

Date Started	04/12/2007
Date Complete:	06/12/2007
Wdle Type:	RO
Equipment	Atlas Copco Mustang ASD

Initial Boring Diameter	125mm
Initial Casing Diameter	114mm
Rotary Casing Type	Symmetry N82
Core Barrel	
Core Bit	DTH

Coord nates	E	431935 40
	N	404015.00
Ground Level		91 27m OD
Plunge		90 °
Scale		1:50

[illegible]

Continued next sheet

U	Undisturbed U100 Sample
P	Piston Sample
TW	Twin Wall Sample
D	Small Disturbed Sample
B	Bulk Disturbed Sample
LB	Large Bulk Disturbed Sample
W	Water Sample
G	Gas Sample
C	Core
DC	Chemical Sample

CR	Core Run
YCR	Total Core Recovery
SCR	Solid Core Recovery
RCD	Rock Quality Designator
FI	Fracture Index
FL	Fracture Log
NI	Non Injact
U*	Blows to drive U100 /U86
NA	No Application
NR	No Recovery

S	Standard Penetration Test
C	Cone Penetration Test
32	N for 300mm penetration
1175	For given penetration (mm)
25A	Seating blows only (mm)
NP	No Penetration
PR	Pressuremeter Test
K	Permeability Test (m/s)
V	Vibro Vane Test
L	Packer Test (Lugeons)

CP	Cable Percussion
RO	Rotary Open Hole
RC	Rotary Cored

ကုမ္ပဏီ

... Sailed 7.30

Результат:

100

2. ~~2.1~~ 2.2 Control

12. Complete

¹ Supri E "B."

DATE: 10/10/10

Bertone Sr

 $\frac{1}{2} \text{Gravimetric } F = 1.47$



ritchies

BOREHOLE LOG

Borehole No
BH2
Sheet 3 of 3

Strafford MWTs

Client: The Coal Authority

Job No: 1975

Consultant: Mott MacDonald

Date Started 04/12/2007

11. Exit Diameter

125mm

Coordinates

F 431935 40

Data Complete 06/12/2007

Intel Casing Diameter

114nm

N 404015 00

HO # Type	RO
1	1
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89	89
90	90
91	91
92	92
93	93
94	94
95	95
96	96
97	97
98	98
99	99
100	100

Rotary Casing Type

Symmetrix NB2

Ground Level

4' 27m 00

Equipment	Atlas Copco Mustang A50
-----------	-------------------------

Core Bates

Munge

90.

Description of State

Remaining Detail: 15.80m - 15.80m ... around 15.8m, driller notes loss of flush, unable to advance BH (see remarks)

End of Borehole at 20.00 m

20 00	71 27
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U	Undisturbed J100 Sample
P	Pack Sample
TW	Thin Wall Sample
D	Disturbed Sample
B	Back Disturbed Sample
LR	Large Bulk Disturbed Sample
W	Waste Sample
G	Gas Sample
S	Soil
EC	Emulsion Sample

TCR	Core Run
SCR	Static Core Recovery
ROD	Static Core Recovery
ROD	Static Core Designation
F	Fracture Index
FL	Fracture Log
N ₀	Neutron n°
U ²³⁵	Flows to core U ²³⁵ / U ²³⁸
NA	Not Applicable
NR	N. Recovery

S	Standard Penetration Test
C	Cone Penetration Test
12	N for full-blown penetration
1.5	For given penetration (mm)
25#	Sealing blows only (mm)
NP	No Penetration
PR	Pressuremeter Test
R	Reinforcing Test (bars)
	in situ Vane Test
V	Packer Test (Lugeon)

CP	Cable Percussion
RO	Rotary Open Hole
RC	Rotary Cased

☐ Installer
☐ Stopped Pipe
☐ Pressure Tap
☒ Control Valve
☐ Control Pipe

Status

Prelim 2

22/01/2008



BOREHOLE LOG

Borehole No

BH2

Information

Strafford MWTS

Client: The Coal Authority

Consultant: Mott MacDonald

Job No: 1975

Date Started: 04/12/2007

Date Complete: 06/12/2007

Hole Type: RO

Equipment: Atlas Copco Mustang A50

Initial Boring Diameter:

125 mm

Initial Casing Diameter:

114 mm

Rotary Casing Type:

Symmetrix N82

Core Barrel:

Core Bit:

DTH

Coordinates:

E 431935.40

N 404015.00

Ground Level:

91.27m OD

Plunge:

90°

Scale:

1:50

PROGRESS

Date	Time	Hole Depth	Casing Depth	Water Depth	Remarks
04/12/2007	18:00	15.80	14.50	-	End of shift
06/12/2007		20.00	14.50	-	BH complete. Dry

DRILLING / SAMPLING DETAILS

CP Chiseling			Probing Details		
From	To	Hours	From	To	Time (mins)
			1.20	2.50	125 mm
			2.50	5.50	125 mm
			5.50	8.50	125 mm
			8.50	11.50	125 mm
			11.50	14.50	125 mm
			14.50	15.80	50 mm
			15.80	19.00	50 mm
			19.00	20.00	50 mm

WATER STRIKES

Date	Time	Strike	Risen to	After 20 minutes	Casing Depth	Flow	Sealed
04/12/2007	00:00	6.00				Slight seepage, dry at 13.7m	

IN SITU SPT TEST DETAILS

Depth	Blows for 75mm increments
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NOTES

All depths in metres, all diameters in millimetres.

Groundwater levels are subject to seasonal, tidal and other fluctuations and should not be taken as constant.

1. Area CAT scanned and inspection pit hand dug to 1.2m prior to drilling commencing
2. During drilling process driller notes partial loss of flush, at 3.5m due to possible voids or loose material, 15.8m unable to advance BH, extracted rods and DTH hammer. Installed Symmetrix N82 casing to 14.5m, re-commenced probing
3. BH terminated at the scheduled depth of 20m, upon the Engineer's instructions
4. Backfill details as follows: 20.0m - GL bentonite pellets

PERSONNEL

Driver: GCG/GCS

Logged by: McK

Checked by: APB

Status
Prelim 2
22/01/2008



ritchies

BOREHOLE LOG

Borehole No
BH3
Sheet 1 of 3

Strafford MWTS

Client: The Coal Authority
Consultant: Mott MacDonald

Job No: 1975

Date Started: 06/12/2007
Date Complete: 06/12/2007
Hole Type: RO
Equipment: Atlas Copco Mustang A50

Initial Boring Diameter: 125mm
Initial Casing Diameter:
Rotary Casing Type:
Core Barrel:
Core Bit: OTH

Coordinates: E 431953.90
N 404031.90
Ground Level: 92.19m OD
Plunge: 90°
Scale: 1:50

Description of Strata	Legend	Depth	Reduced Level	Sampling Core Run	U	In Situ Testing	TCR (SCR) ROD	FI	Installation
MADE GROUND: Black brown gravelly sand (partly of ash). Gravel is angular fine of mudstone and coal.									
Light brown sandy gravelly CLAY. Gravel is angular fine to medium of mudstone		1.30	90.89						
Dark brown CLAY.		2.90	89.29						
Light brown CLAY		3.20	88.99						
Light and dark grey laminated MUDSTONE.		4.30	87.89						

Continued next sheet

U Undisturbed Unaltered Sample
P Platin Sample
TW Thin Wall Sample
D Small Disturbed Sample
B Bulk Disturbed Sample
LB Large Bulk Disturbed Sample
W Water Sample
G Gas Sample
C Core
Dm Drift Sample

TCR Total Core Recovery
SKR Split Core Recovery
ROD Rock Quality Designation
FI Fracture Index
FC Fracture Log
NI Non-Intact
U' Shows to drive 0100-086
NA Not Applicable
NR No Recovery

S Standard Penetration Test
C Core Penetration Test
32 N for full 300mm penetration
175 For given penetration (mm)
250 Swelling flows only (mm)
NP No Penetration
PR Pressuremeter Test
K Permeability Test (m/s)
V Insitu Vane Test
L Packer Test (logarithmic)

CP Cable Penetration
RO Rotary Open Hole
RC Rotary Cased

Installation
S Shaded Pipe
P Piezometer Tip
G Grout
C Concrete
S Sand
S Separate Sand
C Coarse Filter

Status
Prelim 2
22/01/2008



ritchie's

BOREHOLE LOG

Borehole No
BH3
Sheet 2 of 3

Strafford MWTS

Client: The Coal Authority

Job No: 1975

Consultant: Mott MacDonald

Date Started 08/12/2007
Date Complete 08/12/2007
Hole Type RO
Equipment Atlas Copco Mustang A50

Initial Boring Diameter 125mm
Initial Casing Diameter
Rotary Casing Type
Core Barrel
Core Bit DTH

Coordinates E 431953 90
N 404031 90
Ground Level 92.19m OD
Plunge 90°
Scale 1:50

Description of Strata	Legend	Depth	Reduced Level	Sampling/ Core Run	U	In Situ Testing Test Result	TCR [SCR] RQD	FI	Installation
Light and dark grey laminated MUDSTONE									
Dark grey MUDSTONE recovered as, sandy angular fine gravel.		10.00	82.19						
Light grey MUDSTONE recovered as sandy angular fine gravel		14.00	78.19						
Continued next sheet									

U Undisturbed U100 Sample
P Piston Sample
TW Thin Wall Sample
D Small Disturbed Sample
B Bulk Disturbed Sample
LB Large Bulk Disturbed Sample
W Water Sample
G Gas Sample
C Core
DC Chemical Sample

Core Run
TCR Total Core Recovery
SCR Solid Core Recovery
RQD Rock Quality Designation
FI Fracture Index
FL Fracture Log
NI Non-Intact
U* Blows to drive U100/U86
NA Not Applicable
NR No Recovery

S Standard Penetration Test
C Cone Penetration Test
32 N for full 300mm penetration
/175 For given penetration (mm)
25# Seating blows only (mm)
NP No Penetration
PR Pressuremeter Test
K Permeability Test (m/s)
V In Situ Vane Test
L Packer Test (Lugeon)

CP Cable Percussion
RO Rotary Open Hole
RC Rotary Cored

Installation
Scribe Pipe
Piezometer Tip
Grout
Concrete
Sand Filter
 Bentonite Seal
Leak Filter

Status
Prelim 2
22/01/2008



ritchies

BOREHOLE LOG

Borehole No
BH3
Sheet 3 of 3

Strafford MWTS

Client: The Coal Authority

Job No: 1975

Consultant: Mott MacDonald

Date Started 06/12/2007
Date Complete 06/12/2007
Hole Type RO
Equipment Atlas Copco Mustang A50

Initial Boring Diameter 125mm
Initial Casing Diameter
Rotary Casing Type
Core Barrel
Core Bit DTH

Coordinates E 431853.90
N 404031.90
Ground Level 92.19m OD
Plunge 90°
Strike 150°

Description of Strata	Legend	Depth	Reduced Level	Sampling/ Core Run	U	In Situ Testing	TCR (SCR)	FI	Installation
Light grey MUDSTONE recovered as sandy angular fine gravel									
Black COAL recovered as, sandy angular fine gravel		18.40	73.79						
Dark grey MUDSTONE recovered as sandy angular fine gravel		19.20	72.99						
End of Borehole at 20.20 m		20.20	71.99						

U Undisturbed U/Gl Sample
P Piston Sample
TW Thin Wall Sample
D Small Disturbed Sample
B Bulk Disturbed Sample
CB Large Bulk Disturbed Sample
W Water Sample
G Gas Sample
C Core
CC Core Sample

TCR Total Core Recovery
SCR Solid Core Recovery
RQD Rock Quality Designation
FI Fracture Index
NL Non-Intact
U Not Applicable
NR No Recovery

S Standard Penetration Test
C Cone Penetration Test
N for full 300mm penetration
1175 For given penetration (mm)
2400 Seating force (kN)
NP No Penetration
PR Pressuremeter Test
K Permeability Test (m/s)
V Insitu Vane Test
L Packer Test (kPa)

CP Cable Percussion
RO Rotary Open Hole
RC Rotary Cored

Installation
S Solid Pipe
P Perimeter Tip
C Core
C Core
S Solid Filter
B Bentonite Seal
G Gravel Filter

Status
Prelim 2
22/01/2008



BOREHOLE LOG

Borehole No
BH3
Information

Strafford MWTS

Client: The Coal Authority
Consultant: Mott MacDonald

Job No: 1975

Date Started: 06/12/2007
Date Complete: 06/12/2007
Hole Type: RO
Equipment: Atlas Copco Mustang A50

Initial Boring Diameter: 125 mm
Initial Casing Diameter:
Rotary Casing Type:
Core Barrel:
Core Bit: DTH

Coordinates: E 43° 55' 30"
N 404831.90
Ground Level: 92.19m OD
Plunge: 90°
Scale: 1:50

PROGRESS

Date	Time	Hole Depth	Casing Depth	Water Depth
06/12/2007		20.20		

Remarks
BH complete

DRILLING / SAMPLING DETAILS

CP Chiselling			Probing Details		
From	To	Hours	From	To	Time (mins)
			1.20	4.00	125 mm 13 mins
			4.00	7.00	87.5 mm 9 mins
			7.00	10.00	87.5 mm 9 mins
			10.00	13.00	87.5 mm 8 mins
			13.00	16.00	87.5 mm 9 mins
			16.00	19.00	87.5 mm 8 mins
			19.00	20.00	87.5 mm 3 mins

WATER STRIKES

Date	Time	Strike	Risen to	After 20 minutes	Casing Depth	Flow	Sealed
06/12/2007	16.00					Slight seepage	

IN SITU SPT TEST DETAILS

Depth Blows per 75mm increments

NOTES

All depths in metres, all diameters in millimetres

Groundwater levels are subject to seasonal, tidal and other fluctuations and should not be taken as constant

1. Area CAT scanned and inspection pit hand dug to 1.2m prior to drilling commencing.
2. During drilling process driller notes coal seam between 16.4m and 19.2m
3. BH terminated at the scheduled depth of 20.20m upon the Engineer's instructions
4. Backfill details as follows: 20.20m - GL bentonite pellets

PERSONNEL

Driller GC/CO/CS

Logged by M. K

Checked by APB

Status
Prelim 2
22/01/2008



BOREHOLE LOG

Borehole No
BH4
Sheet 1 of 3

Strafford MWTS

Client: The Coal Authority
Consultant: Mott MacDonald

Job No: 1975

Date Started 05/12/2007
Date Complete 05/12/2007
Hole Type RO
Equipment Atlas Copco Mustang A50

Initial Boring Diameter 125mm
Initial Casing Diameter
Rotary Casing Type
Core Barrel
Core Bit DTH

Coordinates E 43°56'23.00"
N 404008.00"
Ground Level 90.32m OD
Plunge 90°
Scale 1:50

Description of Strata
MADE GROUND: Black brown slightly clayey gravelly sand with occasional cobbles of brick. Gravel is angular to sub-rounded of mudstone coal and red weathered mudstone.

Light brown yellow laminated MUDSTONE recovered as, sandy angular fine gravel

Light brown yellow slightly sandy weathered mudstone recovered as, sandy angular fine gravel

Light grey black MUDSTONE recovered as, sandy angular fine gravel.

Continued next sheet

J Undisturbed U100 Sample
P Pot Hole Sample
TW Thin Wall Sample
D Small Disturbed Sample
B Bulk Disturbed Sample
LB Large Bulk Disturbed Sample
W Water Sample
G Gas Sample
C Core
CC Chemical Sample

TCR Total Core Recovery
SCR Solid Core Recovery
RQD Rock Quality Designation
FI Fracture Index
FL Fracture Log
NI Non-Intact
BT Blows to Drive U100 U36
NA Not Applicable
NR No Recovery

S Standard Penetration Test
C Cone Penetration Test
N for full 30°mm penetration
/175 For given penetration (mm)
/254 Sealing blows only (mm)
NP No Penetration
PR Permeability Test
K Permeability Test (m/s)
V In situ Vane Test
L Packer Load (kN/m²)

CP Cable Percussion
RO Rotary Open Hole
RC Rotary Cased

Installation
S Silted Plug
P Permeability Plug
G Gravel
C Concrete
S Silted Plug
B Best in Sed
G Gravel
C Concrete

Status
Prelim 2
22/01/2008

**ritchies** BOREHOLE LOG

Borehole No
BH4
Sheet 2 of 3

Strafford MWTs

Client: The Coal Authority

Job No: 1975

Consultant: Mott MacDonald

Date Started 05/12/2007

Initial Boring Diameter 125mm

Coordinates E 431962 30

Date Complete 05/12/2007

Initial Casing Diameter

N 404008 00

Hole Type: RO

Rotary Casing Type

Ground Level: 90.32m OD

Equipment	Allas Copco Mustang A50
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Core Barrel

Plunge 90°

Core Bit

DTM

Scale, 1 \$0

Description of Strata

Light grey black MUDSTONE recovered as, sandy angular fine gravel

Legend

Depth

Reduced
Level

Sampling/
Core Run

1

In Situ Testing

osing

TCR
(SCR)
800

51

Installation

Continued next sheet

U	Undisturbed JUD Sample
P	Piston Sample
TW	Thin Wall Sample
D	Smart Disturbed Sample
B	Bulk Disturbed Sample
LB	Large Bulk Disturbed Sample
W	Water Sample
G	Gas Sample
C	Core
DC	Chemical Sample

TCR	Total Core Recovery
SCR	Solid Core Recovery
RQD	Rock Quality Designation
FI	Fracture Index
FL	Fracture Log
NI	Non intact
U*	Blows to drive U100 /UH6
NA	Not Applicable
NR	No Recovery

S	Standard Penetration Test
C	Cone Penetration Test
32	N for full 300mm penetration
(175	For given penetration (mm)
1240	Sealing blows only (mm)
NP	No Penetration
Pr	Pressuremeter Test
K	Permeability Test (m/s)
V	Insitu Vane Test
L	Packer Test (kN/m²)

CP	Cable Percussion
RO	Rotary Open Hole
RC	Rotary Cored

Installation	
	Solid Pipe
	Perimeter Tip
	Grout
	Concrete
	Sand Filter
	Bentonite Seal
	Gravel Filter

Status
Prelim 2
22/01/2008



BOREHOLE LOG

Borehole No
BH4
Sheet 3 of 3

Strafford MWTS

Client: The Coal Authority

Job No: 1975

Consultant: Mott MacDonald

Date Started 05/12/2007
Date Complete 05/12/2007
Hole Type RO
Equipment Atlas Copco Mustang A50

Initial Boring Diameter 125mm
Initial Casing Diameter
Rotary Casing Type
Core Barrel
Core B*

Coordinates E 431962 30
N 404008 00
Ground Level 90.32m OD
Plunge 90°
Strike 50°

Description of Strata

Light grey black MUDSTONE recovered as, sandy angular fine gravel

Black COAL recovered as, sandy angular fine gravel.

Grey black MUDSTONE recovered as, sandy angular fine gravel

Black COAL recovered as, sandy angular fine gravel.

Dark grey black MUDSTONE recovered as, sandy angular fine gravel

Legend	Depth	Reduced Level	Sampling/ Core Run	U	In Situ Testing Test	In Situ Testing Result	TCR (SCR) (RQD)	FI	Installation
	16.20	74.12							
	16.60	73.72							
	17.70	72.62							
	17.90	72.42							
	19.00	71.32							

End of Borehole at 19.00 m

J Undisturbed U100 Sample
P Piston Sample
TW Thin Wall Sample
D Small Disturbed Sample
B Bulk Disturbed Sample
LB Large Bulk Disturbed Sample
W Water Sample
G Gas Sample
C Core
CC Chemical Sample

Core Run
TCR Total Core Recovery
SCR Solid Core Recovery
RQD Rock Quality Designation
FI Fracture Index
Fr Fracture Log
NI Not Intact
U* Borehole to drive U100/U96
NA Not Applicable
NR No Recovery

S Standard Penetration Test
C Cone Penetration Test
32 N for full 300mm penetration
125 For given penetration (mm)
25# Splitting blows only (mm)
NP No Penetration
PR Presaturation Test
K Permeability Test (m/s)
V Insitu Vane Test
L Parker Test (Lugeons)

CP Cable Penetration
RO Rotary Open Hole
RC Rotary Core

Installation
S Sited Pps
P Prozone Tip
G Grout
C Concrete
S Sited Pps
B Borehole Seal
G Gravel Filter

Status
Prelim 2
22/01/2008



BOREHOLE LOG

Borehole No
BH4
Information

Strafford MWTS

Client: The Coal Authority
Consultant: Mott MacDonald

Job No: 1975

Date Started: 05/12/2007
Date Complete: 05/12/2007
Hole Type: RD
Equipment: Atlas Copco Mustang A50

Initial Boring Diameter: 125 mm
Initial Casing Diameter:
Rotary Casing Type:
Core Barrel:
Core Bit: DTH

Coordinates: E 43° 962 30
N 404008 00
Ground Level: 90.32m OD
Plunge: 90°
Scale: 1:50

PROGRESS

Date	Time	Hole Depth	Casing Depth	Water Depth	Remarks
05/12/2007		19.00			BH complete

DRILLING / SAMPLING DETAILS

CP Chiselling			Proving Details		
From	To	Hours	From	To	Time (mins)
			13.00	13.00	9 mins
			13.00	16.00	10 mins
			16.00	19.00	8 mins

WATER STRIKES

Date	Time	Strike	Risen to	After 20 minutes	Casing Depth	Flow
05/12/2007		16.00				Slight seepage

IN SITU SPT TEST DETAILS

Sealed	Depth	Blows for 75mm increments
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NOTES

All depths in metres, all diameters in millimetres.

Groundwater levels are subject to seasonal, tidal and other fluctuations and should not be taken as constant.

1. Area CAT scanned and inspection pit hand dug to 1.2m prior to drilling commencing.
2. During drilling process driller notes 2m coal seams between 16.2m and 16.6m, 17.7m and 17.9m respectively.
3. BH terminated at the scheduled depth of 19.0m upon the Engineer's instructions.
4. Backfill details as follows: 19.0m - G. bentonite pellets.

PERSONNEL

Driller: GC/CG/CS

Logged by: IM/K

Checked by: APB

Status

Prelim 2

22/01/2008



ritchie's BOREHOLE LOG

Borehole No

BH5

Sheet 1 of 2

Strafford MWTS

Client: The Coal Authority

Job No: 1975

Consultant: Mott MacDonald

Date Started: 05/12/2007

Initial Boring Diameter: 125mm

Coordinates: E 43°59'59.80"

Date Complete: 05/12/2007

Initial Casing Diameter:

N 40°43'21.23"

Hole Type: RO

Rotary Casing Type:

Ground Level: 91.04m OD

Equipment: Atlas Copco Mustang A50

Core Barrel:

Purge: 30"

Core Bit:

DTH:

Scale: 1:50

Description of Strata	Legend	Depth	Reduced Level	Sampling/ Core Run	U	In Situ Testing Test Result	TCR (SCR) ROD	FI	Installation
MADE GROUND: Light brown yellow slightly clayey gravelly sand with occasional cobbles of brick. Gravel is sub-angular to sub-rounded fine to medium of sandstone and mudstone.									
Light brown sandy gravelly CLAY. Gravel is angular to sub-rounded of mudstone.		2.00	89.04						
Light brown grey weathered MUDSTONE recovered as sandy angular fine gravel.		4.70	86.34						

Continued next sheet

U Undisturbed 11130 Sample
 P Piston Sample
 TW Thin Wall Sample
 D Shrink Disturbed Sample
 B Bulk Disturbed Sample
 LB Large Bulk Disturbed Sample
 W Water Sample
 G Gas Sample
 C Core
 CH Chemical Sample

CR Core Run
 TCR Total Core Recovery
 SCR Solid Core Recovery
 ROD Rock Quality Designation
 F Fracture Index
 FL Fracture Log
 NI Non-Intact
 U Blows to Drive 11130 195
 NA Not Applicable
 NR No Recovery

S Standard Penetration Test
 C Core Penetration Test
 32 Actual 50mm penetration
 175 For given penetration (mm)
 125 Sealing Blows only (mm)
 NP No Penetration
 PR Pressuremeter Test
 K Permeability Test (m/s)
 V V to V3 in Test
 L Packer Test (Lugeon)

CP Cable Percussion
 RO Rotary Open Hole
 RC Rotary Cased

Installation
 SP Slotted Pipe
 PZ Percussion Tip
 G Grout
 L Liner

Sand Filler
 Bentonite Seal
 Gravel Filter

Status
Prelim 2
22/01/2008



BOREHOLE LOG

Borehole No
BH5
Sheet 2 of 2

Strafford MWTS

Client: The Coal Authority

Job No: 1975

Consultant: Mott MacDonald

Date Started 05/12/2007
Date Complete 05/12/2007
Hole Type RO
Equipment Atlas Copco Mustang A50

Initial Boring Diameter 125mm
Initial Casing Diameter
Rotary Casing Type
Core Barrel
Core Bit

Coordinates E 431989.80
N 404021.20
Ground Level 91.04m OD
Plunge 90°
Scale 1:50

Description of Strata	Legend	Depth	Reduced Level	Sampling/ Core Run	U	In Situ Test	Typing Result	TCR (SCR) RQD	FI	Insta- lation
Light brown grey weathered MUDSTONE recovered as, sandy angular fine gravel.										
between 10.0m and 12.7m, fractured weak ground with loss of flush and increased rate of penetration (possible void)										
between 12.7m and 14.0m, driller records solid ground with no returns due to loss of flush										
End of Borehole at 14.00 m		14.00	77.04							

U Undisturbed U100 Sample
P Piston Sample
TW Thin Wall Sample
D Small Disturbed Sample
B Bulk Disturbed Sample
LB Large Bulk Disturbed Sample
W Water Sample
G Gas Sample
C Core
DC Chemical Sample

TCR Total Core Recovery
SCR Solid Core Recovery
RQD Rock Quality Designation
FI Fracture Index
FL Fracture Log
NI Non Intact
U* Blows to drive U100 R.88
NA Not Applicable
NR No Recovery

S Standard Penetration Test
C Cone Penetration Test
32 N for full 300mm penetration
1175 For given penetration (mm)
125# Seating blows only (mm)
NP No Penetration
PR Pressurimeter Test
K Permeability Test (m/s)
V Insitu Vane Test
L Packer Test (Lugeons)

CP Cable Percussion
RU Rotary Open Hole
RC Rotary Cored

Installation
S Silted Pipe
P Piezometer Tip
G Grout
C Concrete
S Sand Filter
B Bentonite Seal
G Gravel Filter

Status
Prelim 2
22/01/2008



BOREHOLE LOG

Borehole No
BH5
Information

Strafford MWTS

Client: The Coal Authority
Consultant: Mott MacDonald

Job No: 1975

Date Started 05/12/2007
Date Complete 05/12/2007
Hole Type RO
Equipment Atlas Copco Mustang A50

Initial Boring Diameter 125 mm
Initial Casing Diameter
Rotary Casing Type
Core Barrel
Core Bit DTH

Coordinates E 43° 989.80
N 404021.20
Ground Level 91.04m OD
Plunge 90°
Scale 1:50

PROGRESS

Date	Time	Hole Depth	Casing Depth	Water Depth	Remarks
05/12/2007		14.00			BH complete

DRILLING / SAMPLING DETAILS

CP Chiselling			Probing Details		
From	To	Hours	From	To	Time (mins)
	1.20		4.00	125 mm	10 mins
	7.00		10.00	125 mm	9 mins
	10.00		12.00	125 mm	2 mins

WATER STRIKES

Date	Time	Strike	Flow to	After 20 minutes	Casing Depth	Flow
05/12/2007		14.00				Slight seepage

IN SITU SPT TEST DETAILS

Sealing	Depth	Blows for 75mm increments
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NOTES

All depths in metres, all diameters in millimetres

Groundwater levels are subject to seasonal, local and other fluctuations and should not be taken as constant

1. Area CAT scanned and inspect in pit hand dug to 1.2m prior to drilling commencing
2. During drilling process, driller notes loss of flush between 10.0m and 12.0m due to fractured ground, between 12.0m and 14.0m due to no return with no solids return
3. BH terminated at the scheduled depth of 14.0m upon the Engineer's instructions
4. Backfill details as follows: 14.0m - GL

PERSONNEL

Drawn: CGR/GCS

Logged by: IM K

Checked by: APB

Status
Prelim 2
22/01/2008



BOREHOLE LOG

Borehole No
BH6
Sheet 1 of 3

Strafford MWTS

Client: The Coal Authority

Job No: 1975

Consultant: Mott MacDonald

Date Started 08/12/2007
Date Complete 08/12/2007
Hole Type RO
Equipment Atlas Copco Mustang A50

Initial Boring Diameter 125mm
Initial Casing Diameter
Rotary Casing Type
Core Barrel
Core Bit DTH

Coordinates E 431997.30
N 404042.40
Ground Level 92.27m OD
Plunge 90°
Scale 1:50

Description of Strata	Legend	Depth	Reduced Level	Sampling/ Core Run	J	In Situ Testing		TCR (SCR)	FI	Installation
						Test	Result			
MADE GROUND: Brown black sandy gravelly clay with occasional angular cobbles of mudstone (with inclusions of coal) and brick.		0.70	91.57							
Light brown slightly sandy gravelly CLAY. Gravel is angular fine to medium of mudstone										
Light grey brown black MUDSTONE recovered as, sandy angular fine gravel.		4.50	87.77							

Continued next sheet

U Un-disturbed J100 Sample
P Piston Sample
TW Thin Wall Sample
D Small Disturbed Sample
B Bulk Disturbed Sample
LB Large Bulk Disturbed Sample
W Water Sample
C Gas Sample
C Core
CC Chemical Sample

CR Core Run
TCR Total Core Recovery
SCR Solid Core Recovery
RQD Rock Quality Designation
FI Fracture Index
FL Fracture Log
NI Non-Intact
U* Bore to drive J100 / J86
NA Not Applicable
NR No Recovery

S Standard Penetration Test
C Cone Penetration Test
N* for full 300mm penetration
/175 For given penetration (mm)
/25# Seating blows only (mm)
NP No Penetration
PR Pressuremeter Test
K Permeability Test (m/s)
V Insitu Vane Test
L Packer Test (Lugeons)

CP Cable Percussion
RO Rotary Open Hole
RC Rotary Cased

Installation
 Slotted Pipe
 Piezometer Tip
 Grout
 Concrete
 Sand Filter
 Bentonite Seal
 Gravel Filler



ritchies

BOREHOLE LOG

Borehole No
BH6
Sheet 2 of 3

Strafford MWTs

Client: The Coal Authority

Job No: 1975

Consultant: Mott MacDonald

Date Started 06/12/2007

Initial Boring Diameter 125mm

Coord Dates E 431997 30

Date Complete 08/22/07

Initial Casing Diameter

N 404012 40

Howe Type	RO
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Rotary Casing Type

Ground Level 32.27m OD

Equipment	Atlas Copco Mustang A50
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Core Barrel

Plunge 90°

C. 39 B'

DTM

Scale: 1-50

Description of Sites

Light grey brown black MUDSTONE recovered as,
sandy angular fine gravel.

Dark grey MUDSTONE recovered as sandy angular fine gravel

Continued next sheet

U	Undisturbed UCC Sample
F	Push Sample
Tw	Two-Way Sample
D	Small Disturbed Sample
B	Small Bulk Disturbed Sample
LB	Large Bulk Disturbed Sample
W	Wet Sample
G	Grout Sample
C	Core Sample
JC	Confined Core Sample

CCF	Correlation Coefficient
CRF	Cost Recovery Factor
CRP	Cost Recovery Percentage
CRQ	Cost Recovery Quota
CRS	Cost Recovery System
CRU	Cost Recovery Unit
CRV	Cost Recovery Value
CRW	Cost Recovery Weight
CRX	Cost Recovery X
CRY	Cost Recovery Y
CRZ	Cost Recovery Z
CR1	Cost Recovery 1
CR2	Cost Recovery 2
CR3	Cost Recovery 3
CR4	Cost Recovery 4
CR5	Cost Recovery 5
CR6	Cost Recovery 6
CR7	Cost Recovery 7
CR8	Cost Recovery 8
CR9	Cost Recovery 9
CR10	Cost Recovery 10
CR11	Cost Recovery 11
CR12	Cost Recovery 12
CR13	Cost Recovery 13
CR14	Cost Recovery 14
CR15	Cost Recovery 15
CR16	Cost Recovery 16
CR17	Cost Recovery 17
CR18	Cost Recovery 18
CR19	Cost Recovery 19
CR20	Cost Recovery 20
CR21	Cost Recovery 21
CR22	Cost Recovery 22
CR23	Cost Recovery 23
CR24	Cost Recovery 24
CR25	Cost Recovery 25
CR26	Cost Recovery 26
CR27	Cost Recovery 27
CR28	Cost Recovery 28
CR29	Cost Recovery 29
CR30	Cost Recovery 30
CR31	Cost Recovery 31
CR32	Cost Recovery 32
CR33	Cost Recovery 33
CR34	Cost Recovery 34
CR35	Cost Recovery 35
CR36	Cost Recovery 36
CR37	Cost Recovery 37
CR38	Cost Recovery 38
CR39	Cost Recovery 39
CR40	Cost Recovery 40
CR41	Cost Recovery 41
CR42	Cost Recovery 42
CR43	Cost Recovery 43
CR44	Cost Recovery 44
CR45	Cost Recovery 45
CR46	Cost Recovery 46
CR47	Cost Recovery 47
CR48	Cost Recovery 48
CR49	Cost Recovery 49
CR50	Cost Recovery 50
CR51	Cost Recovery 51
CR52	Cost Recovery 52
CR53	Cost Recovery 53
CR54	Cost Recovery 54
CR55	Cost Recovery 55
CR56	Cost Recovery 56
CR57	Cost Recovery 57
CR58	Cost Recovery 58
CR59	Cost Recovery 59
CR60	Cost Recovery 60
CR61	Cost Recovery 61
CR62	Cost Recovery 62
CR63	Cost Recovery 63
CR64	Cost Recovery 64
CR65	Cost Recovery 65
CR66	Cost Recovery 66
CR67	Cost Recovery 67
CR68	Cost Recovery 68
CR69	Cost Recovery 69
CR70	Cost Recovery 70
CR71	Cost Recovery 71
CR72	Cost Recovery 72
CR73	Cost Recovery 73
CR74	Cost Recovery 74
CR75	Cost Recovery 75
CR76	Cost Recovery 76
CR77	Cost Recovery 77
CR78	Cost Recovery 78
CR79	Cost Recovery 79
CR80	Cost Recovery 80
CR81	Cost Recovery 81
CR82	Cost Recovery 82
CR83	Cost Recovery 83
CR84	Cost Recovery 84
CR85	Cost Recovery 85
CR86	Cost Recovery 86
CR87	Cost Recovery 87
CR88	Cost Recovery 88
CR89	Cost Recovery 89
CR90	Cost Recovery 90
CR91	Cost Recovery 91
CR92	Cost Recovery 92
CR93	Cost Recovery 93
CR94	Cost Recovery 94
CR95	Cost Recovery 95
CR96	Cost Recovery 96
CR97	Cost Recovery 97
CR98	Cost Recovery 98
CR99	Cost Recovery 99
CR100	Cost Recovery 100

S	Standard Penetration Test
C	Cone Penetration Test
32	4 in. for full 30 mm penetration
1275	for given penetration (mm)
1244	Sealing blows per sq. mm
NP	Ni Penetration
PR	Pressuremeter Test
K	Permeability Test (m/s)
V	Inst. Vane Test
L	Penetration Test (logarithmic)

CP	Call to Participation
RD	Rotary Club House
RC	Rotary Council

 Rolled Pipe
 Sand Filler
 Perforator Tip
 Bentonite Seal
 Gravel
 Gravel Filler
 Concrete

Status
Prelim 2
22/01/2008



BOREHOLE LOG

Borehole No
BH6
Sheet 3 of 3

Strafford MWTS

Client: The Coal Authority

Job No: 1975

Consultant: Mott MacDonald

Date Started 06/12/2007
Date Complete 06/12/2007
Hole Type RO
Equipment: Atlas Copco Mustang A50

Initial Boring Diameter 125mm
Initial Casing Diameter
Rotary Casing Type
Core Barrel
Core Bit DTH

Coordinates E 431997.30
N 404042.40
Ground Level 92.27m OD
Plunge 90°
Scale 1:50

Description of Strata	Legend	Depth	Reduced Level	Sampling/ Core Run	U	In Situ Testing		TCR (SCR) RQD	FI	Installation
						Test	Result			
Dark grey MUDSTONE recovered as, sandy angular fine gravel										
Light grey MUDSTONE recovered as, sandy angular fine gravel		17.50	74.77							
Dark grey MUDSTONE recovered as, sandy angular fine gravel.		19.80	72.47							
End of Borehole at 20.00 m		20.00	72.27							

U Undisturbed U100 Sample
P Piston Sample
TV Thin Wall Sample
D Small Disturbed Sample
B Bulk Disturbed Sample
LB Large Bulk Disturbed Sample
W Water Sample
G Gas Sample
C Core
DC Chemical Sample

Core Run
TCR Total Core Recovery
SCR Solid Core Recovery
RQD Rock Quality Designation
FI Fracture Index
FL Fracture Log
NI Non Intact
J* Blows to drive U100 /UBS
NA Not Applicable
NR No Recovery

S Standard Penetration Test
C Cone Penetration Test
N for full 300mm penetration
/175 For given penetration (mm)
/25# Seating blows only (mm)
NP No Penetration
PR Pressuremeter Test
K Permeability Test (m/s)
V In situ Vane Test
L Packer Test (Lugeons)

CP Cable Penetration
RO Rotary Open Hole
RC Rotary Cored

Installation
S Silted Pipe
P Piezometer Tip
G Grout
C Concrete
Sand Filter
B Bentonite Seal
Gravel Filter

Status
Prelim 2
22/01/2008



BOREHOLE LOG

Borehole No
BH6
Information

Strafford MWTS

Client: The Coal Authority
Consultant: Mott MacDonald

Job No: 1975

Date Started 06/12/2007
Date Complete 06/12/2007
Hole Type RO
Equipment Atlas Copco Mustang A50

Initial Boring Diameter 125 mm
Initial Casing Diameter
Rotary Casing Type
Core Barre
Core Bit DTH

Coordinates E 43°19'30"
N 404042.40
Ground Level 92.27m OD
Purge 90°
Scale 1:50

PROGRESS

Date	Time	Hole Depth	Casing Depth	Water Depth	Remarks
06-12-2007		20.00			BH complete Dry

DRILLING / SAMPLING DETAILS

CP Chasing			Probing Details		
From	To	Hours	From	To	Time (mins)
			1.20	4.00	125 mm 7 mins
			4.00	7.00	87.5 mm 6 mins
			7.00	10.00	87.5 mm 10 mins
			10.00	13.00	87.5 mm 15 mins
			13.00	16.00	87.5 mm 10 mins
			16.00	19.00	87.5 mm 12 mins
			19.00	20.00	87.5 mm 5 mins

WATER STRIKES

Date	Time	Strike	Risen to	After 20 minutes	Casing Depth	Flow
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IN SITU SPT TEST DETAILS

Shard	Depth	Blows for 75mm increments
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NOTES

All depths in metres, all diameters in millimetres.

Groundwater levels are subject to seasonal, tidal, and other fluctuations and should not be taken as constant.

- Area CAT scanned and inspection of hand dug to 1.2m prior to drilling commencing.
- BH terminated at the scheduled depth of 20.0m upon the Engineer's instructions.
- Backfill details as follows: 20.0m - GCB bentonite pellets.

PERSONNEL

Driller GC/CUC

Engineer by MCK

Checked by APH

Status
Prelim 2
22/01/2008



ritchie's

BOREHOLE LOG

Borehole No
BH7
Sheet 1 of 2

Strafford MWTS

Client: The Coal Authority

Job No: 1975

Consultant: Mott MacDonald

Date Started 05/12/2007
Date Complete 05/12/2007
Hole Type RO
Equipment Atlas Copco Mustang A50

Initial Boring Diameter 125mm
Initial Casing Diameter
Rotary Casing Type
Core Barrel
Core Bit DTH

Coordinates E 432018 90
N 404035 70
Ground Level 90.17m OD
Plunge 90°
Scale 1:50

Description of Strata
MADE GROUND. Black brown sandy (predominately of ash) gravel with occasional cobbles of brick. Gravel is angular to sub-rounded of brick mudstone and coal.

Dark grey black MUDSTONE with red light brown weathered outer surface recovered as, sandy angular fine gravel

Dark grey black MUDSTONE with light brown yellow weathered outer surface recovered as, sandy angular fine gravel

Continued next sheet

U Undisturbed U100 Sample
P Piston Sample
TW Thin Wall Sample
D Small Disturbed Sample
B Bulk Disturbed Sample
LB Large Bulk Disturbed Sample
W Water Sample
G Gas Sample
C Core
DC Chemical Sample

TCR Total Core Recovery
SCR Solid Core Recovery
ROD Rock Quality Designation
FI Fracture Index
FL Fracture Log
NI Non Intact
U* Blows to drive U100 /U85
NA Not Applicable
NR No Recovery

S Standard Penetration Test
C Cone Penetration Test
32 N for full 300mm penetration
1175 For given penetration (mm)
125# Sealing blows only (mm)
NP No Penetration
PR Pressuremeter Test
K Permeability Test (mvs)
V in situ Vane Test
L Packer Test (Lugeons)

CP Cable Percussion
RO Rotary Open Hole
RC Rotary Cored

Installation
S Silted Pipe
P Perforator Tip
G Grout
C Concrete
S Silt Filter
R Reverse Seal
G Gravel Filter

Status
Prelim 2
22/01/2008



BOREHOLE LOG

Borehole No
BH7
Sheet 2 of 2

Strafford MWTS

Client: The Coal Authority
Consultant: Mott MacDonald

Job No: 1975

Date Started: 05/12/2007
Date Complete: 05/12/2007
Hole Type: FO
Equipment: Atlas Copco Mustang A50

Initial Boring Diameter: 125mm
Initial Casing Diameter:
Rotary Casing Type:
Core Barrel:
Core Bit: DTH

Coordinates: E 432018.90
N 404035.70
Ground Level: 90.17m OD
Plunge: 90°
Scale: 1:50

Description of Strata
Dark grey black MUDSTONE with light brown yellow weathered outer surface recovered as, sandy angular fine gravel

Grey black MUDSTONE recovered as, sandy angular fine gravel

between 14.0m and 14.6m, fractured weak ground with loss of flush (possible voids)

between 14.6m and 15.6m, driller notes solid ground with no returns due to loss of flush

End of Borehole at 15.60 m

Legend	Depth	Reduced Level	Sampling/ Core Run	U	In Situ Testing Test	Result	TCR (SCR) RQD	F	Installation
	11.50	78.67							
	15.60	74.57							

U Unsturbed U100 Sample
P Piston Sample
TW Thin Wall Sample
D Small Disturbed Sample
B Bulk Disturbed Sample
LB Large Bulk Disturbed Sample
W Water Sample
G Gas Sample
C Core
GC Chemical Sample

TCR Total Core Recovery
SCR Solid Core Recovery
RQD Rock Quality Designation
FI Fracture Index
FL Fracture Log
NI Non Inert
U' Blows to drive U100/U86
NA Not Applicable
NR No Recovery

S Standard Penetration Test
C Cone Penetration Test
32 N for full 300mm penetration
125 For given penetration (mm)
254 Sealing blows only (mm)
NP No Penetration
PR Pressuremeter Test
K Permeability Test (m/s)
V Insitu Vane Test
L Packer and Logistical

CP Cable Percussion
RO Rotary Open Hole
RC Rotary Core

Installation
H Sinker Pipe
P Packer Tip
G Grout
C Cement
S Sand Filter
B Bentonite Seal
G Gravel Filter

Status

Prelim 2

22/01/2008



ritchies BOREHOLE LOG

Borehole No

BH7

Information

Strafford MWTS

Client: The Coal Authority

Consultant: Mott MacDonald

Job No: 1975

Date Started 05/12/2007

Date Complete 05/12/2007

Hole Type RQ

Equipment Atlas Copco Mustang A50

Initial Boring Diameter 125 mm

Initial Casing Diameter:

Rotary Casing Type

Core Barrel

Core Bit

DTH

Coordinates E 432018 90

N 404035 70

Ground Level 90.17m OD

Plunge 90 °

Scale 1:50

PROGRESS

DRILLING / SAMPLING DETAILS

Date	Time	Hole Depth	Casing Depth	Water Depth	Remarks	CP Chiselling			Probing Details		Time (mins)
						From	To	Hours	From	To	
05/12/2007		15.60			BH complete				7.00	10.00	125 mm 8 mins
									10.00	13.00	125 mm 9 mins
									14.60	15.60	125 mm 6 mins

WATER STRIKES

IN SITU SPT TEST DETAILS

Date	Time	Strike	Risen to	After 20 minutes	Casing Depth	Flow	Sealed	Depth	Blows for 75mm increments
05/12/2007	14.00					Slight seepage			

NOTES

All depths in metres, all diameters in millimetres.

Groundwater levels are subject to seasonal, tida and other fluctuations and should not be taken as constant

1. Area CAT scanned and inspection pit hand dug to 1.2m prior to drilling commencing
2. During drilling process driller notes loss of flush, between 14.0m and 14.6m due to void, between 14.6m and 15.6m due to no returns within solid ground
3. BH terminated at the scheduled depth of 15.6m upon the Engineer's instructions
4. Backfill details as follows: 15.6m - GL bentonite pellets

PERSONNEL

Driller CG/GC/CS

Logged by IMcK

Checked by

APB